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The use of Adobe in Architecture, and an analysis of its uses in Costa Rica.

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Abstract:

Adobe has been an essential material in architecture across a plethora of civilizations, from ancient Mesopotamia to Latin American culture. Its ease of access, thermal behaviour and efficiency and durability compared to other construction methods in the epoch made it a relevant technique in construction throughout the ages.

The following paper is an analysis of the principles of adobe construction, its preparation and mechanical properties as well as a morphological study of the traditional adobe dwellings and its impact in Costa Rican architecture with the main objective of evidencing the importance of preserving its legacy and promoting its restoration and relevancy in the current architectural dialogue for Costa Rica.

The paper presents diagrammatic illustrations depicting the traditional layout, materiality and morphology of traditional adobe dwellings in Costa Rica during and after the Spanish conquest of the Americas, and an exposition as to how adobe construction was a sustainable and thermally efficient solution for the climatic conditions of the country.

The relevance of studying traditional vernacular architecture in the Costa Rican paradigm presents itself as an opportunity to approach the sustainable construction goals that the country aims for, whilst in parallel highlighting traditional architectural styles can become a valuable addition to the current architectonic dialogue in the nation.

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1. Introduction:

1.1 The Historical Use of Adobe in Architecture.

The use of Adobe, or the construction of the built objects and dwellings using sun-dried bricks of soil is of high importance to the history of architecture. The use of adobe construction played a transcendental role in the shaping of the built architectural legacy of ancient civilizations and helped as well in preserving the legacy of the architectures of the past. Adobe constructions can be traced back to more than 4000 years ago, and simultaneously across continents where the humidity, soil, and weather conditions allowed for its construction to be erected. The word in Spanish: “adobe” comes from the Arabic “*attob*” derived from the Egyptian “*thobe*” which translates to sun-dried mud brick. (R. Illampas, I. Ioannou & D. C. Charnpis). ; nevertheless, its appearance and use in the Americas predates the colonization of the continent by the Spanish. One can simply recall the impact of the material in the edifications of the Los Morteros, a large architectural site in the northern region of Chao, Peru; where significant discoveries revealed the usage of such material by the Incan societies, allowing them to construct massive structures, homes and monuments. Moreover, in the north, Aztec and Mayan ceramics have been unsurfaced; elements such as cooking utensils, pots, statues, and architectural ornaments in clay evidence the exposure to the material that the Pre-Columbian civilizations clearly had to the technique of sun dried, mud elements.

1.2 Adobe Architecture in Costa Rica

In the Costa Rican paradigm, adobe edifications were most prominently executed during the Spanish colonial period, as well as the “bahareque” construction technique (one that is similar in structural performance, and in material preparation and construction). One may then recall how the use of the material in historically poorer regions of the Spanish nation, adobe was used as an effective material for construction; as was the case in many neighbouring countries as well in the mediterranean; Egypt, Portugal, Italy, and of course Spain; where Ortega refers to Adobe as the Brick and Stone of the poor, in a publication for a Castilian community exposing the historical relevance of this vernacular construction technique in his vicinity (Ortega, D. 2022); it then makes logical sense that this proven affordable material would be implemented in the unknown new territories of the Spanish colonies in the New World.

Ever since its introduction in the Colonial Period, this construction technique was able to maintain itself relevant until around the XIXth century. This edification technique utilized the readily available materials on site, as well as took advantage of the sun exposure, to produce a reliable building technology for the construction of residential, ecclesiastical and public buildings. This construction material saw its most relevant and important uses in the regions of the Central Valley, and the North Pacific of Costa Rica, primarily due to the local climate which in terms of precipitation, humidity and temperature favoured the technical properties of the building material. (Richard Woodbridge). In 1910, after the devastation of the Cartago Earthquake, the construction of new adobe structures saw a significant halting in new dwellings, and all efforts towards the materials where shifted to the restoration of the damaged structures.

The legacy of adobe construction in Costa Rican architectural patrimony is as significant as that of the Marimba to traditional music, or the “Carreta” to national symbols. The essence of Colonial Costa Rica is not complete without the iconic two-coloured adobe constructions and its distinct “Tejas” in their roofs. Contemporary Architecture in Costa Rica unfortunately hasn’t appeared interested in reviving this traditional building technique, nevertheless the reasons for this rejection by the Architectural Practice will be exposed and discussed further along this paper.



Figure 1: Adobe house in Santo Domingo de Heredia

From: <https://semanarioextensionista.blogspot.com/2012/06/198-herencia-cultural-casas-de-adobe-de.html>

Adobe technology in this manner has become a subject of Cultural Patrimony and legacy; for this reason, it has been delegated as a field of study for restorers, architectural conservation, and legacy of the built environment professionals.

2. Methodology:

2.1 Methodology of analysis and exposition of the paper

The present paper has the aim to expose the elaboration of adobe dwellings as a form of building technology, the main construction techniques, the technical limitations of the materials, the main structural properties, and then will go into detail in analysis of the architectural legacy and patrimony in Costa Rican architecture by a reconstruction from the available data of how adobe dwellings used to be designed.

The aim of this paper is to be an expository document, where information from multiple sources will be presented together, to gain a more thorough understanding of how the material behaves. Scientific sources from independent articles, from university papers and magazines, as well as international and national publications that expose the historical, societal, and technological impact of the construction of such dwellings.

The primary source of technical and structural analysis from which the information was recollected however, is reduced to climatically relevant and similar regions to that of Costa Rica, as unfortunately no scientific publications were readily available at the moment of writing the present document, and as this is being written outside of this nation, one cannot conduct the corresponding tests with the adequate natural circumstances. Nevertheless, it is worth noting that the Adobe construction under the Spanish dominion of the American Provinces, saw a similar technical manufacturing process of the adobe products, as the technique was brought from the old world to the new world, the main structural differences arise from the difference in the mud from which such parts are being fabricated; yet, for the purpose of this essay, we can assume that these differences are close to negligible as edifications maintain a relatively similar structural behaviour, and performance once submitted to similar natural forces; (i.e., earthquakes, rain, etc),

Once the exposition of the material properties, and main characteristics has been completed, a series of Adobe House Typologies will be presented, reconstructed by the author, to then hold a discussion where, the main objective is to analyse punctually the decrease in adobe construction in Costa Rica and other regions in Latin America, as well as governmental efforts towards preserving the architectural legacy of these buildings and the main reasons behind it.

Finally, the paper aims to present a conclusion on the importance of the material, as well as a clear delimitation of the advantages and disadvantages, the challenges and obstacles the technique has to overcome, and finally a glimpse towards the potential of reincorporating Adobe as a sustainable and affordable practice.

3. Results:

3.1 Adobe technology and preparation.

As stated by ” Piani, T. Li; Weerheijm, J.; Sluys, L. J.” traditional adobe bricks are the result of the mixture of clay, sand, silt, water and air; and in the case of some historical built structures it was complemented with the addition of a locally sourced organic material like animal waste.

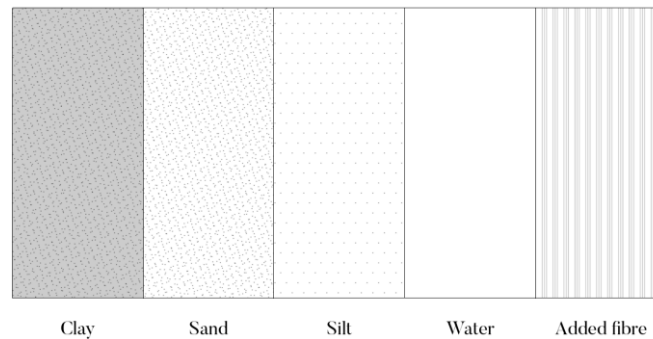


Figure 2: Components of adobe brick products.

Made by the author.

With the pass of time, regulations towards adobe technology have been implemented in order to control the structural parameters and behaviour of the dwellings, nevertheless, these codes differ within each other depending on the region. All the building codes available however, agree in selecting soils with no organic content and avoiding soluble salt content (above the range of 0.5%-2%). For this reason, modern edifications that use adobe products shall not be produced with “Top Soil” this is the soil closest to the surface, instead excavation and extraction from underground is recommended as to avoid the undesired contents in the mixing solution of the bricks. The mixture is then done with potable water, according to code recommendations. Clay content in the admixture is of significance as it behaves as the binder for the fraction of the soil with no cohesion properties and is responsible for providing strength and rigidity to the dried material. According to the analysis conducted by (Piani, T. Li; Weerheijm, J.; Sluys, L. J), by

comparing multiple construction codes, a minimum weight content of clay of 10% is required to be present, however discrepancies appear regarding a maximum aggregate of clay size in the different territories. Also of importance is the mineralogical family of the clay, as well as its proportion to the other particles of the soil mixture. The behaviour of the clay can also be of significance as if it behaves as an expansive material once mixed with water and the other particle mixtures, they can be prone to cracking once transformed into a finalized brick product. In the following figure, (Piani, T. Li; Weerheijm, J.; Sluys, L. J) present a balance of the permitted ranges of soil components as sampled by different regulation codes. Refer to figure 3.

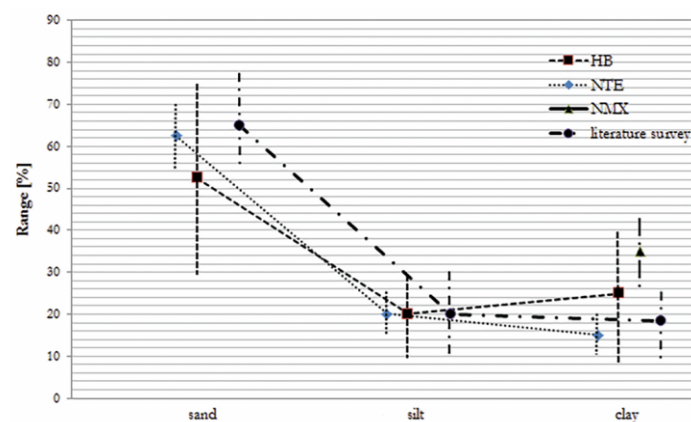


Figure 3: Chart exposing the Range in (%) of the Sand, Silt, and Clay content in three specific regulation codes. The figure illustrates the difference between proportional content in the mixture for the adobe mud product varying region to region, however remaining more or less in similar within each other.

Made by Piani, T. Li; Weerheijm, J.; Sluys, L. J

Where:

- Australian Regulations are: **HB**
- Peruvian Regulations are: **NTE**
- New Mexico Regulations are: **NMX**

In addition, fibres in the mixture can have a significant effect on the material performance against stresses and strains. Fibres allow for better drainage systems through the fibre cavities; and, depending on the region, some guidelines suggest the inclusion of rice, barley, maize, wheat, and can even extend to animal hairs in some cases. Because of the inclusion of such fibres, the

physical-mechanical behaviour of the material can be impacted, thus, the properties of the mixtures after fibre inclusion is currently not regulated by adobe standards globally.

3.2 Adobe bricks as a structural component

As a structural component in a building, it is essential to understand the material properties that compose the brick product that is adobe, as well as its mechanical behaviour and reaction to tensile stresses, compression stresses, and other challenges that are of crucial importance when designing with this material. (R. Illampas, I. Ioannou & D. C. Charmpis) in their paper published by the University of Cyprus, conducted a research project with samples of consistent admixtures and origin, as well as a uniform dimension in brick sizes. Their sample size was as follows: 5 x 30 x 45 cm³ bricks, and followed a consistent elaboration process. It is worth noting that, for relevancy to this paper and the case of Costa Rican architecture in particular, the manufacturing of the adobe bricks most probably did not receive such a controlled production, and in turn must probably perceived a more non homogenous mixture as the one exposed in scientific papers; nevertheless, this approximation to the “standard” of how adobe bricks must behave are essential in understanding the general behaviour of structures of this nature, and for this reason are consistent with the aims of this exposition paper.

In their research the bricks where subjected to a series of uniaxial compression tests, for which the brick products where cut by a masonry saw to the dimension of 5 x 10 x 10 cm³, and where oven dried to a consistent mass at 70 degrees C. After evening of the upper and lower surfaces to allow for an even distribution of loads during the test, a compression testing machine delivered a 300kN force with two parallel steel loading plates. All the test were conducted under ambient conditions (22oC and 55% RH), until a 33%vertical deformation. Failure was characterized by diagonal cracks, and specimens undertook inelastic deformations, this is a change in the geometry of the object upon equilibrium forces that is persistent once these forces are removed. They sustained the ability to withstand compressive loading. In accordance to the study conducted by . (R. Illampas, I. Ioannou & D. C. Charmpis), the lack of a valid failure criteria for defining the load bearing capacity of the adobe materials, gave path to uncertainties in defining the true value of the earth-based material’s compressive strength. The results of their investigation was compiled in the following figure:

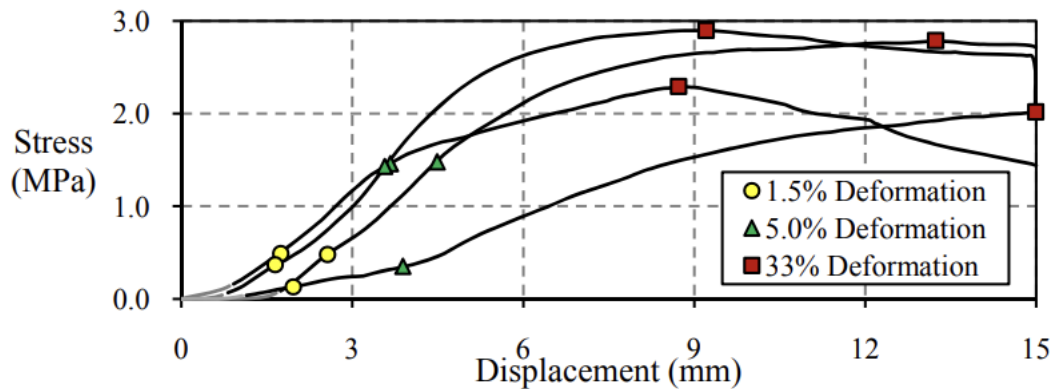


Figure 4: Stress Displacement curves extracted from:
A study of the mechanical behaviour of adobe masonry

In regards of their Flexural Strength, studies backed by the regulation code of New Mexico (also revised by Piani in the previous literature review), the brick products were halved in size, and then placed in parallel tube supports, 30cm apart, and a concentrated force was applied at a rate of 0.9mm/min to a horizontal tube placed in the middle of the brick, until a failure point was reached. The results evidenced that the mode of failure under flexion forces is impacted by discontinuities in the admixture, this meaning that a correlation between the homogeneity of the final mixture had a direct relation to the way the material behaved in these conditions. These discrepancies in the mass homogeneity arose primarily from the presence of gravel or shrinkage cracks, which once being subject to the force, behaved as places of weakness, thus decreasing the bearing capacity of the unit. This information plays a relevant role in identifying primarily how the earth derived material can be affected by the conditions in which it was manufactured and as well with how environmental factors have a direct impact in the material performance of adobe.

3.3 Adobe construction in Costa Rica

Adobe in Costa Rican architecture is often catalogued as a historical-traditional construction material of earthen origin, sun dried, and then assembled into individual brick units to erect dwellings (Asline Solano Leitón) These structures, also referred to as Vernacular Architecture, reflect a sample of culture and societal progress on the specific geographical sites.

Adobe dwellings in Costa Rica saw a more uniform development in terms of structure and layout in the establishment of the principal Spanish settlements in the country, the most important being Cartago, the capital of the once province of the Empire. According to historical depictions by Manuel de Jesus Jimenez, the city centre of Cartago was characterized by houses “of adobes and red roof tiles”; nevertheless these structures were never designed with proper protection or prevention for their optimal conservation in mind. Cited by literature is the case of the Parochial Church of Santiago, which collapsed due to improper maintenance and bad construction.

These earthen dwellings featured a simple and functional floor plan, with a rectangular or square layout, one or two floors, with compact distribution of spaces and rooms. In an interesting manner, these dwellings, especially in rural settings, where in close connection with the exterior, with little to no differentiation between an interior or an exterior space, Such conditions could only be achieved as the climatic conditions allowed for the openness of spaces to not become a challenge, in the absence of a “designated winter season”. Gathered from information on the internet, the following floor plans depict traditional layouts of how these earthen homes were distributed, specifically with information from the municipality of Escazu, a once primarily rural settlement in Costa Rica

3.4 Adobe House 1

Adobe House 1
Based on retrieved information from the internet
Location: Around the Escazu Rural Areas
Type: Detached unit

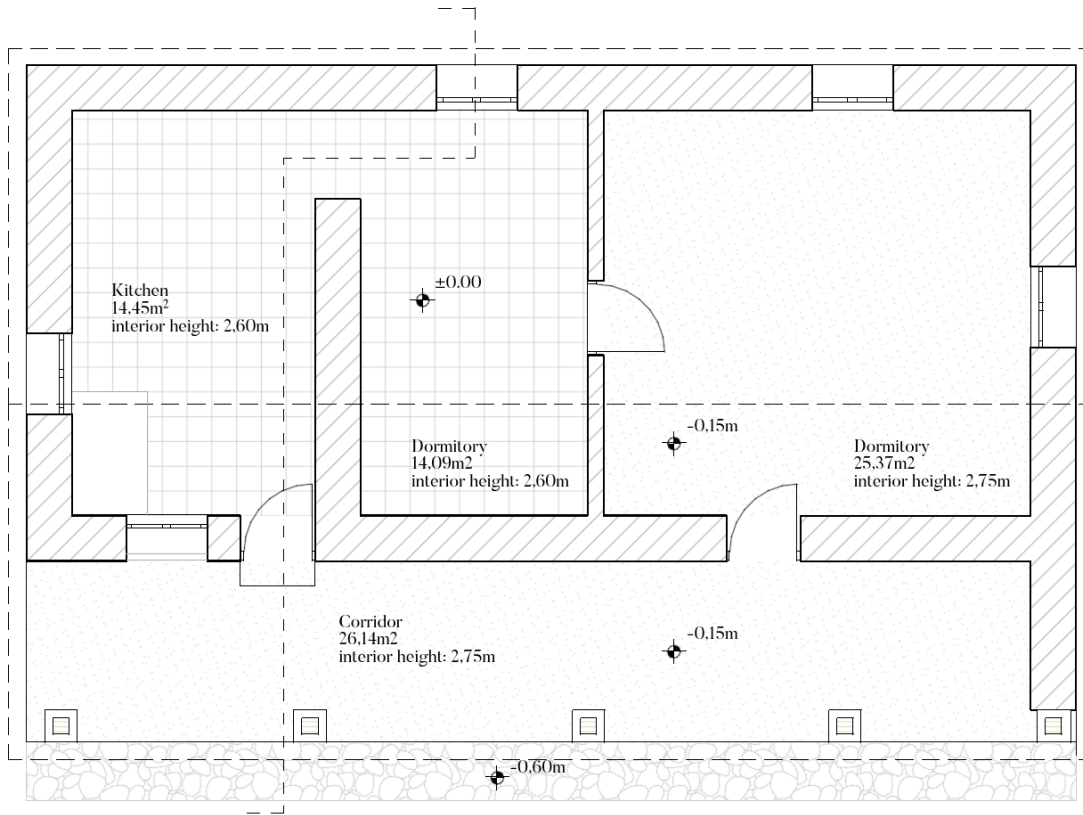


Figure 5: Distribution of an Adobe House 1

Made by the author.

The Following Floor Plan has been designed in reference to the accessed imagery during the literature review and depicts the most standard layout and distribution of the “Traditional rural adobe house” in the country. Of important notice, is how traditionally, the main element of what made a home, was not the interior spaces, instead it was the corridor which connected the home to the exterior. Also of significance was the reduced number of openings in these traditional homes. The Kitchen and main dormitory were often separated functions, and often found a different surface finishing. Most rural examples saw the dormitory of the home without a flooring material and left the compacted soil surface as the top layer. A thickness of usually 55cm adobe masonry walls was the standard for construction, in order to properly bear the load of the wooden structure for the pitched roofs, characteristic of the vernacular architecture.

Adobe House 1

Based on retrieved information from the internet

Location: Around the Escazu Rural Areas

Type: Detached unit

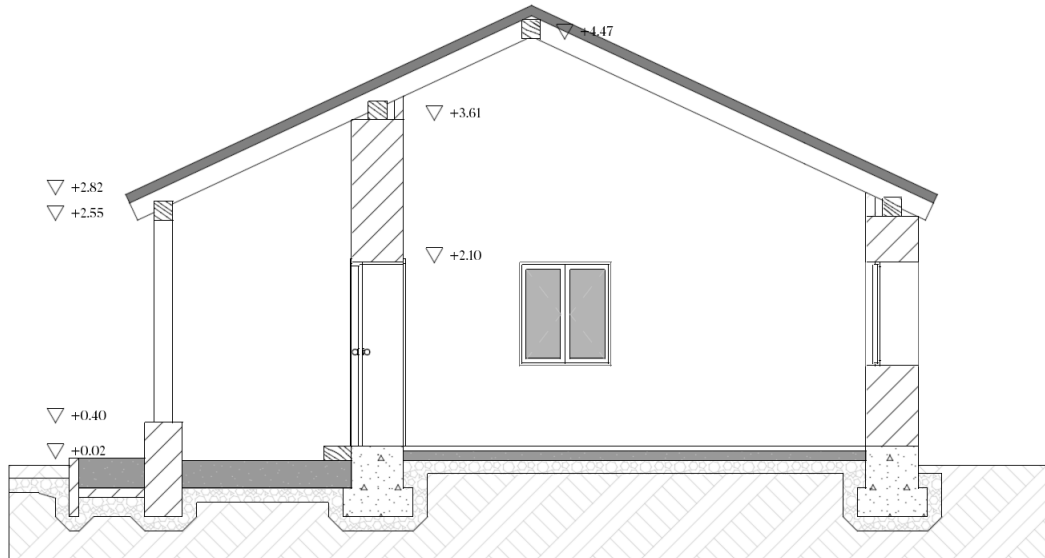


Figure 6: Conceptual Section of an Adobe House 1

Made by the author.

In this proposed section of how the dwelling stood, we can appreciate the relevant thickness of the adobe structure in comparison to the habitable space. If one were to contrast this to the current regulations of loadbearing reinforced concrete walls in Costa Rica, where standards go from as thin as 15cm up to 25cm, one can start to draw conclusions and assumptions about certain conditions of the interior space. Primarily a characteristic of these adobe dwellings, was the comfortable interior temperature that could be achieved within the home, primarily as the high thermal mass, and the notable thickness of the walls, allowed for a cooler and fresher temperature within the walls of the structure. Most constructions in Costa Rica now cannot boast of this condition, and instead rely on mechanical cooling devices to achieve these desired interior conditions. However, the mechanical properties of the material, makes it extremely vulnerable to tensile stresses, and given that Costa Rica is in a considerably seismic region, these dwellings faced constant collapses, and had to be often rebuilt.

Adobe House 1
Based on retrieved information from the internet
Location: Around the Escazu Rural Areas
Type: Detached unit

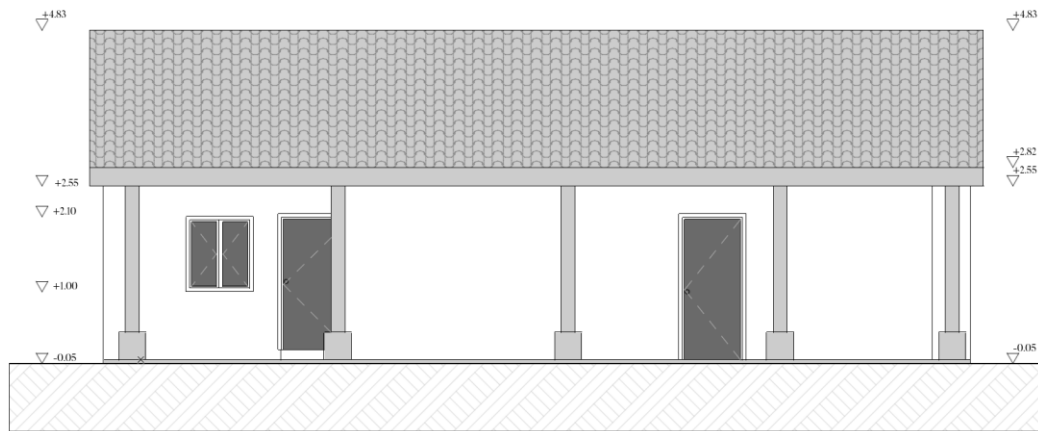


Figure 7: Conceptual Elevation of an Adobe House 1

Made by the author.

In terms of their elevations, the characteristic corridor also plays a pivotal role in the external appearance of the structure. It is worth noting that, most probably, aesthetics was not the most important concern for the rural peoples building these homes, thus was not considered above functionality. Also of important notice is the small number of window openings present in the dwelling. No conclusions can be drawn for the reason behind this lack of façade perforations; however, it remains consistent with the sample materials recollected by the literature.



Figure 8: Conceptual Axonometric of an Adobe House 1

Made by the author.

3.5 Adobe House 2

Adobe House 2
Based on retrieved information from the internet
Location: Around the Escazu Rural Areas
Type: Detached unit

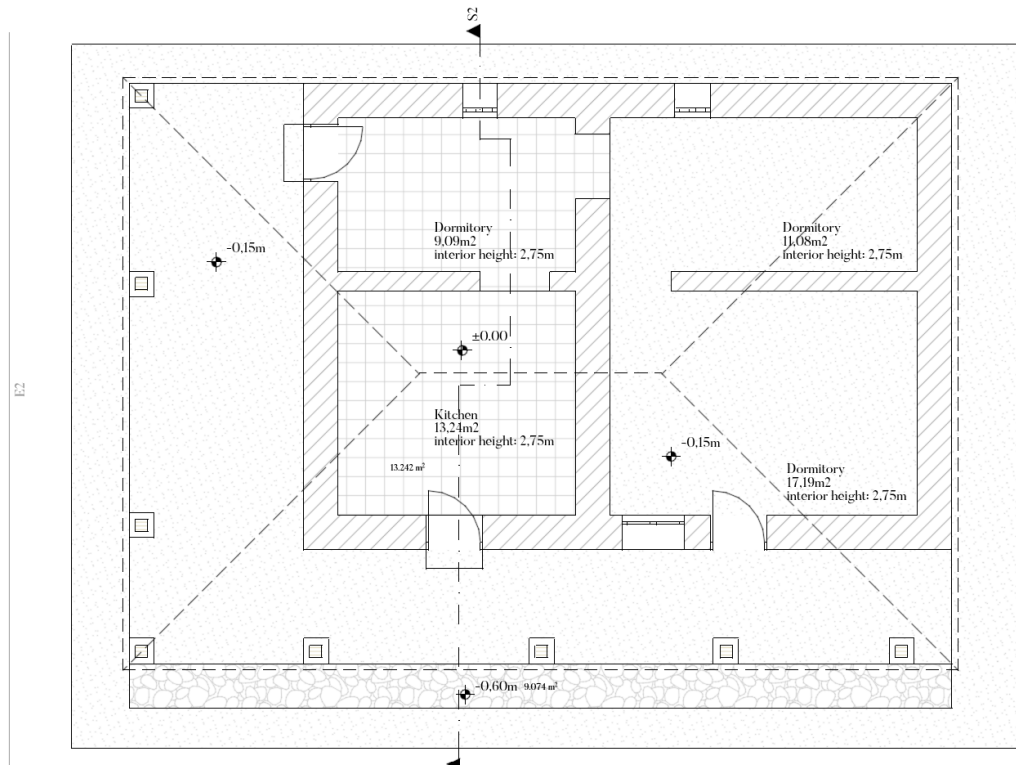


Figure 9: Floor Plan of a traditional adobe house 2, 4 pitched roof

Made by the author.

For the purpose of analysing variations on the typical layout of traditional adobe homes, a more equilateral floor plan has been developed with information gathered from the literature, where the corridor space now envelops two of the facades of the dwelling. Naturally, the corridor becomes one of the most important elements of the traditional vernacular home, as it not only behaves as an architectural transition space, it also connects the different functions of the rooms, as well as characterizes the aesthetical language of a Costa Rican house.

After studying available information on the construction of these historical residential units, one should come to notice the existence of partition walls in the structure; where a differentiation can be made between loadbearing, or merely function driven interior walls. The presence of these thick interior walls behave as interior structural supports for the structure, acting as an intermediate supporting element, allowing the vertical loads of the structure to be redistributed more evenly, rather than leaving them completely to the four encompassing walls.

Adobe House 2

Based on retrieved information from the internet
Location: Around the Escazu Rural Areas
Type: Detached unit

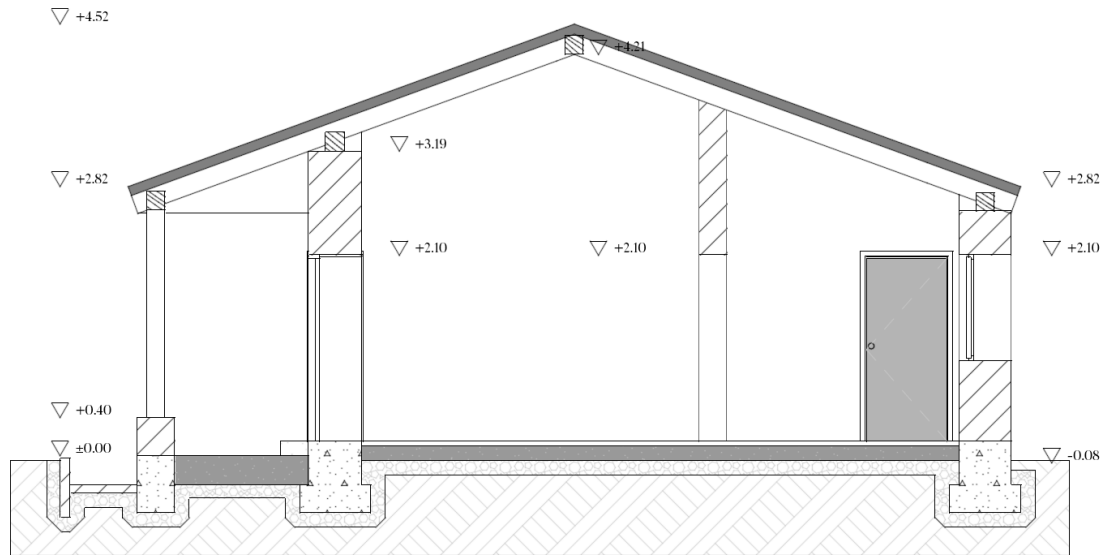


Figure 10: Conceptual Section of a traditional adobe house 2, 4 pitched roof

Made by the author.

Adobe House 2

Based on retrieved information from the internet
Location: Around the Escazu Rural Areas
Type: Detached unit

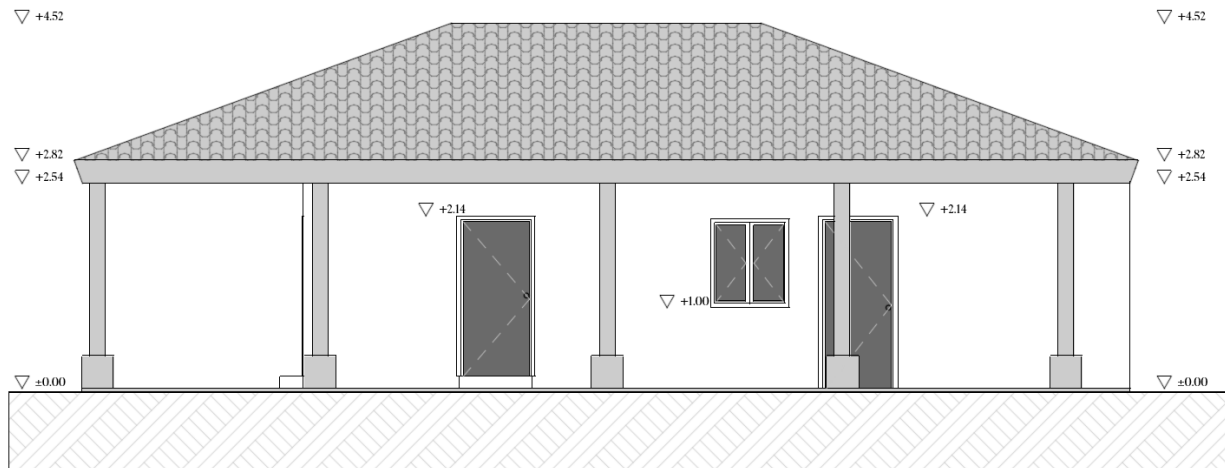


Figure 11: Conceptual Elevation of a traditional adobe house 2, 4 pitched roof

Made by the author.

Adobe House 2
 Based on retrieved information from the internet
 Location: Around the Escazu Rural Areas
 Type: Detached unit

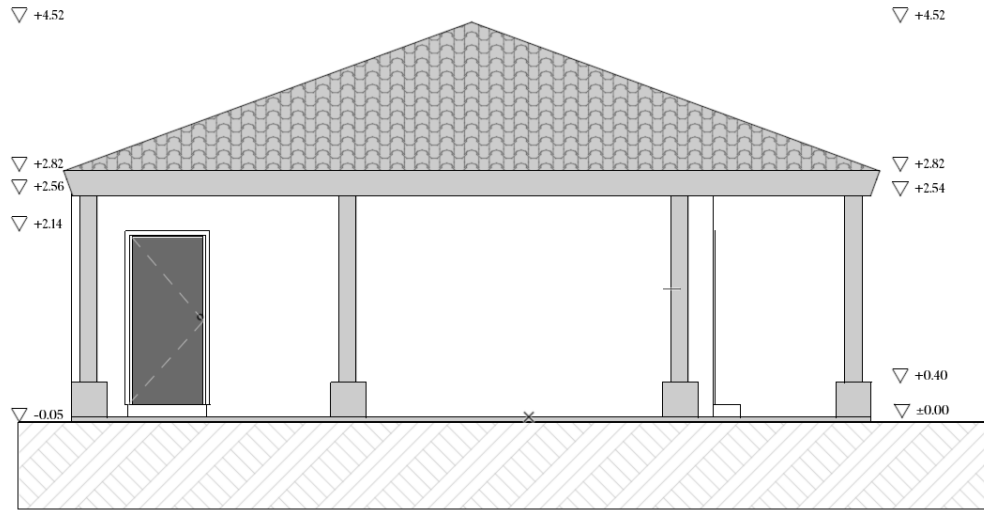


Figure 12: Conceptual Elevation 2 of a traditional adobe house 2, 4 pitched roof

Made by the author.

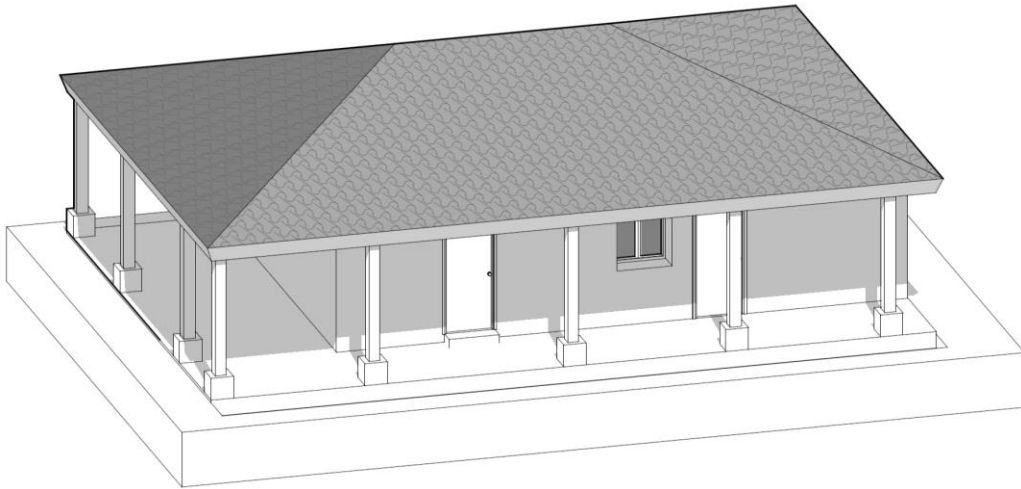


Figure 13: Conceptual Axonometric of a traditional adobe house 2, 4 pitched roof

Made by the author.

3.6 Adobe House 3

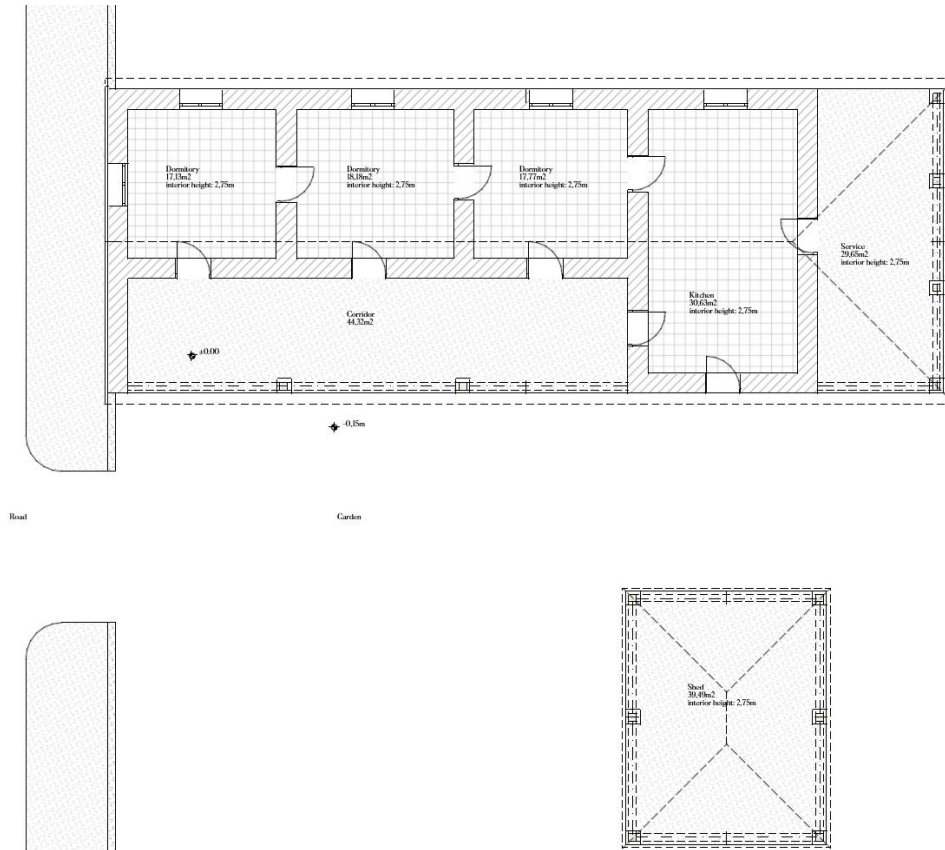


Figure 14: Floor Plan of an Adobe House in front of a street, with interior garden and shed.

Made by the author.

Further analysis shifts us to study the morphology of adobe dwellings in relationship to the street. This participant in the urban dialogue of everyday life becomes very important in determining how the house responds to the necessity of moving harvested goods, or artisanal crafts, to the central markets of more urbanized settlements. Here, the cart becomes another inhabitant and user of the adobe home, and from there, it incorporates itself into the elements that characterize the image of the traditional Colonial Home: Adobe houses, connection with the surrounding nature, and the cart to move goods to and from the residence.

In the present example, the adobe structure reacts in a perpendicular manner to the street against which it lies, thus framing the interior garden, which then becomes the “office” of the house (if by office we define the designated workspace inside the residential unit). For this reason, the appearance of sheds became common, as a way to store goods, the cart, wood, or relevant materials. These sheds were often erected on the same wooden pillars that aided in carrying the

weight of the wooden roof structure in the adobe house. The bathroom however, was not included inside the dwelling, as this modern invention would not appear until the industrial revolution, and wouldn't reach the nation until later on in time.

Adobe House 3
Based on retrieved information from the internet
Location: Around the Escarzu Rural Areas
Type: Street facing

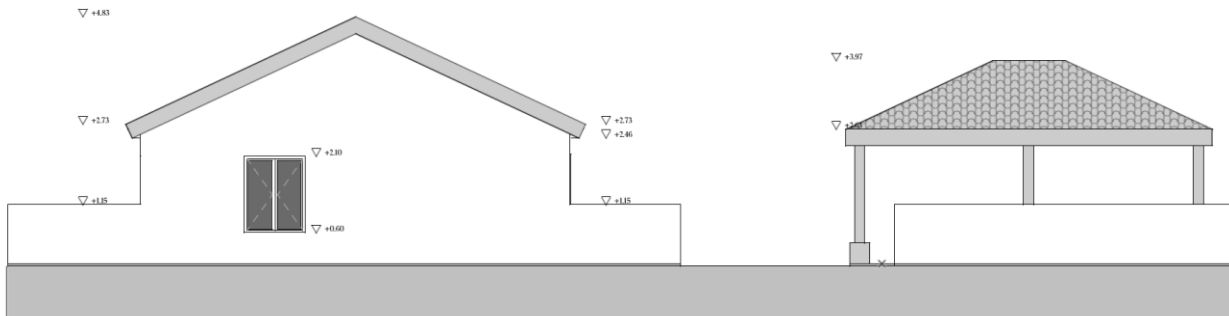


Figure 15: Elevation of an Adobe House in front of a street, with interior garden and shed.

Made by the author.

Adobe House 3
Based on retrieved information from the internet
Location: Around the Escarzu Rural Areas
Type: Street facing

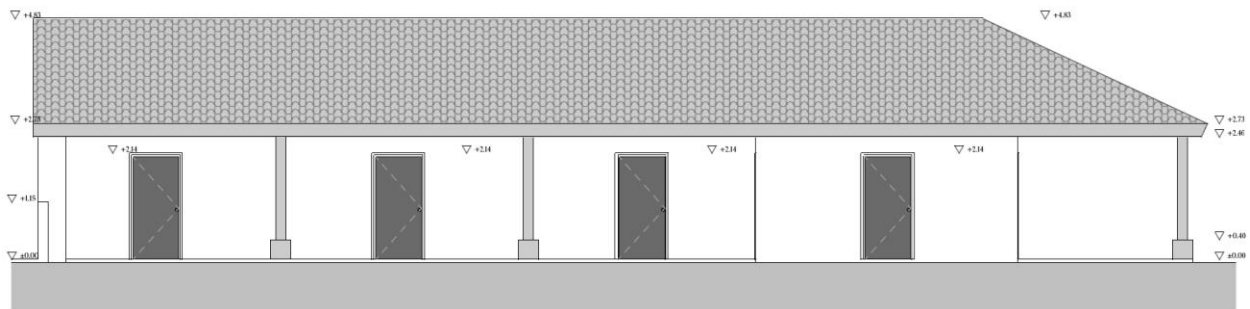


Figure 16: Elevation of an Adobe House in front of a street, with interior garden and shed.

Made by the author.

In terms of the elevation, the design language of adobe houses remained similar to the last two given examples, where the corridor is flanked by a row of doors, opening to the different room functions within the home. Here it is worth mentioning how the Costa Rican adobe house is often depicted in a characteristic colour combination of a white plaster or paint covering the masonry walls, with blue accentuations in the wooden columns, and in some cases a painted “wall base” of

around 20-30cm above the finished floor level. The origin of this design morphology clearly descends from European influence, as it can also be perceived in Nicaragua, Guatemala, and other countries that formed part of the Spanish Empire in the Americas.

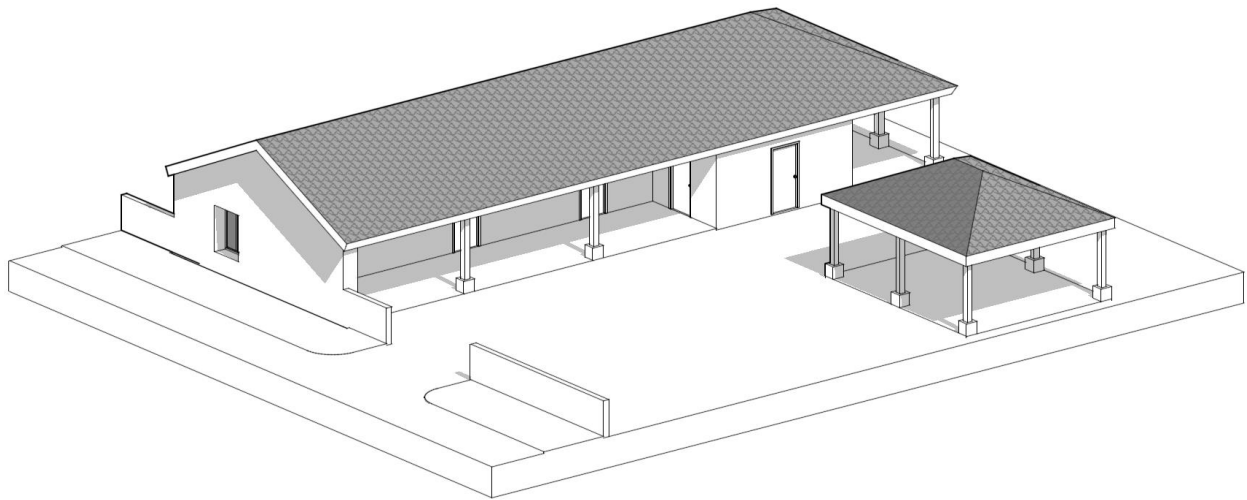


Figure 17: Axonometry of an Adobe House in front of a street, with interior garden and shed.

Made by the author.

As for the overall morphological composition, once more the importance of the central courtyard, in this case an open green space, is emphasized with all the volumes working in collaboration with each other to place it in a central position, thus allowing for convenient access to it from the different components. Also of notice is how the roofing system of the adobe dwellings was also a developed constructional practice, allowing homeowners to have different roof endings as in the above given example in House 3, where the street facing façade ends in a gable roof and has three pitched planes in the other faces of the roof. The Sheds also became an important element of the residential home, acting as an extension of the interior, where different functionalities could be given to the room.

3.7 Adobe House 4

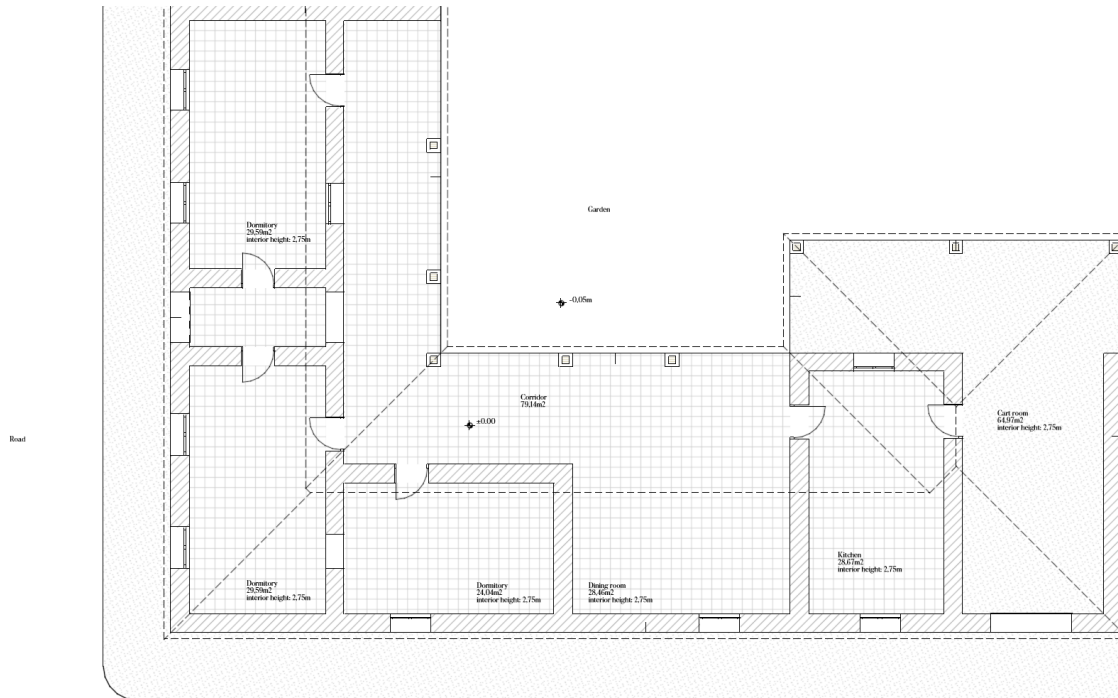


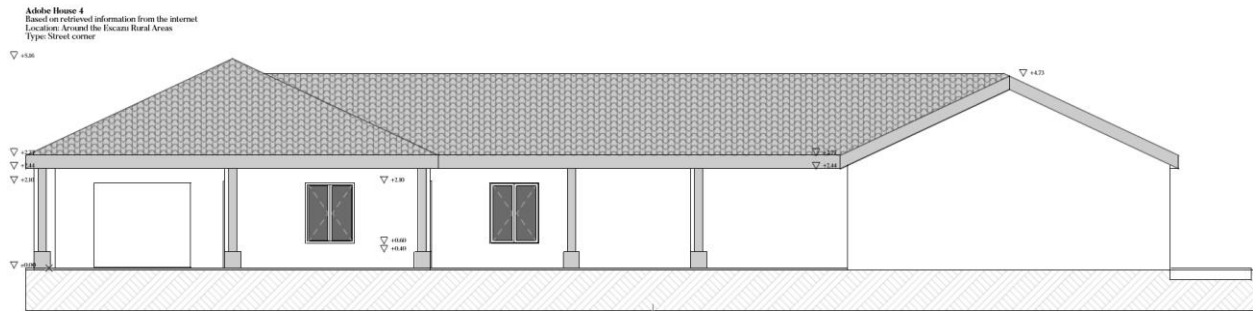
Figure 18: Floor Plan of an Adobe House in a corner street junction, with interior garden and cart storage room.

Made by the author.

Finally, as a last example we will analyze the way in which the given dwelling may react to a street corner situation is presented above. The present example of course deals with a more affluent homeownership, evidenced by the consistent elevated flooring across the rooms, and extended to the corridor. Once more, the centrality of the space's distribution is done along the perimeter of a central courtyard. Also worth highlighting is the existence of a designated parking space for the Cart, and its proximity to the kitchen room.

This architectural elevation drawing shows a building facade with a gabled roof. The roof is covered in a pattern of small, repeating 'v' shapes, representing tiles. The roofline is marked with elevations: +1.73 on the left, +5.36 at the peak, and +4.70 on the right. The main wall is white and features four windows. The first two windows on the left are double doors with 'X' patterns, with elevations of +2.30 and +2.30. The third window is a single door with an elevation of +2.30. The fourth window is a double door with an elevation of +2.30. The ground level is marked with elevations: +0.00 on the left, +0.60 in the middle, and +0.00 on the right. The building is set on a foundation with a diagonal hatching pattern.

Made by the author.



Made by the author.

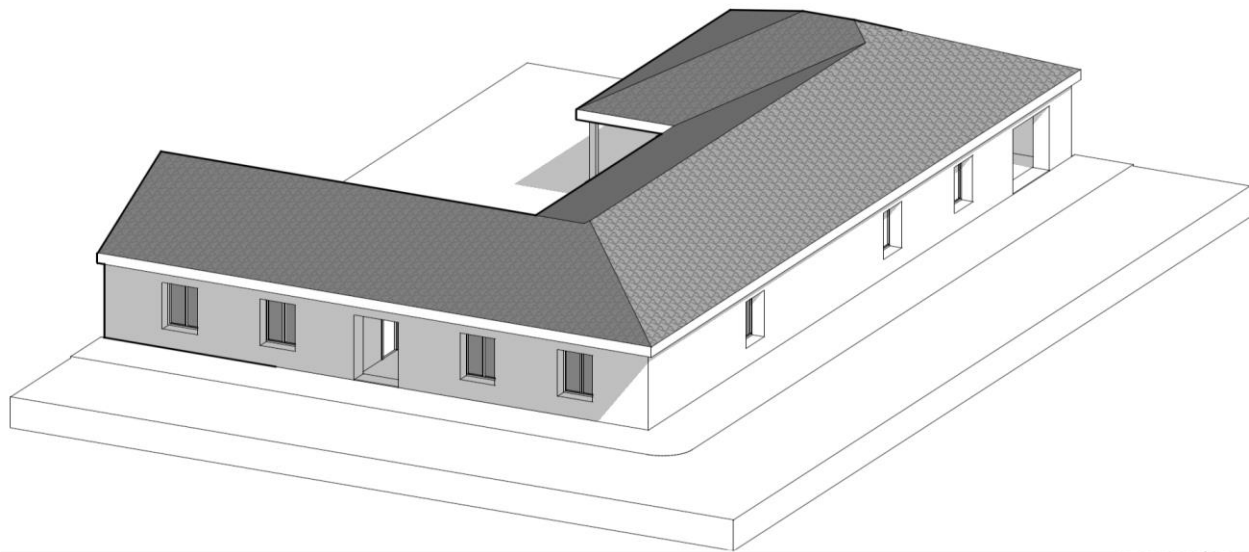


Figure 21: Elevation of an Adobe House in a corner street junction, with interior garden and cart storage room.

Made by the author.

The house morphologically speaking behaves in an introspective manner, this meaning that the elevations facing the street are more reserved and with less openings, whereas facing the courtyard, a more considerable amount of perforations can be found, also allowing for a more heightened interconnection between the interior and the exterior. Gable roofs, and traditional solutions are utilized depending on the desire of the homeowners, and the built context surrounding the dwelling.

4. Discourse and Conclusion:

4.1 The impact of adobe in Costa Rican architecture.

As one of the smallest territories that compromised the “General Captaincy of Guatemala”, the governmental subdivision within the Spanish colonies of the Americas to which Costa Rica belonged to, our national identity and image was highly impacted by the way our homes looked. Romantic tales of those now depleted or tumbled adobe structures have inspired many national artists to create beautiful nostalgic art. The national image of Costa Rica is synonymous with vernacular architecture, with the same relevance as coffee, the traditional Cart, and the Bueyes are. The forces of nature and time have evidently taken a heavy toll on the condition of many of these historical residential units, however a certain negligence and ignorance towards the matter is

highly palpable in the Costa Rican political scene, which in turn also played an important role in the destruction of this valuable architectural patrimony for the Costa Rican people. It is essential that nationals are provided with more extensive literature about the architectural legacy that allowed for the colourful nation of Costa Rica to blossom to its current state. Vernacular Architecture's values are in parallel to the modern sustainability-focused approach to living that has dominated the national status quo for the past 20 years; from the sustainable and degradable materials from which the main masonry walls are erected, to the connection and sensibility to the natural environment; adobe architecture clearly deserves more attention than the one that it is receiving in the current architectural scene.

Governments are to conduct more in detail investigations about the historical structures, their distribution across the land, and allow citizens to understand the legacy of the lands they inhabit today, as respect for national history should be an intrinsic value of a modern Costa Rican citizen. With only a handful of museums that preserve this patrimony in the nation's history, with some of these receiving little to no governmental funds, it is imperative that a more engaged approach to vernacular architecture's legacy is taken into account within the municipalities of the country; otherwise, the significance of the typical adobe house will tumble to the ground.

A considerable potential lays in the restoration of historical adobe dwellings, as these can become interest points for historical research, archaeological explorations, and most relevantly to today's context: tourism. As of the moment of writing this paper, Costa Rica thrives in offering exciting experiences to locals and foreigners for exploring beautiful natural settings, volcanoes, beaches and forests; leaving the possibility of investing in historical projects of this matter. In a positive loop, nationals can preserve their patrimony whilst as well being able to generate interest and potentially income to their local communities. To add to this potential, the available knowledge about adobe architecture, and restoration projects of earthen architecture all across the world, the field of study is a more thoroughly understood science, and can be brought back into the architectural practice in Costa Rica. Across the world, an increasing number of people have shown interest in recuperating the historical legacy of past societies, and with a global increase in Eco-tourism, Farm-tourism, and similar nature motivated tourism, an opportunity may be presented in investing in the traditional form of vernacular architecture. In addition to all of this, adobe technology presents itself as an alternative to the more carbon impactful industry that is

reinforced concrete, in addition to the benefits of the high thermal efficiency that thick vernacular walls offer.

Multiple contemporary examples of architectural works in the material can also be considered, as a reference to appreciate the newest breakthroughs in the field. Due to adobe's earthen origin, some construction offices have been able to incorporate adobe into 3D printing technologies, which can represent alternative uses for the material.

With adobe the possibilities are quite abundant, and there is a lot of interest in reviving this once neglected construction technique. Efforts are being made worldwide to find adobe construction its rightful space in the catalogue of powerful and impactful materials in the architectural field. It is for this reason that we look positively towards an increased awareness of the material properties of adobe.

As a final statement, we wish to encourage further experimentation, studying, categorization and deepening into the historical knowledge of architecture in Costa Rica, as its citizens deserve architecture that is rich in technological advancements, but as well culturally rich and context aware. The future of Costa Rican architecture is quite uncertain, as it currently finds itself in the process of defining its validity and authenticity in the Latin-American panorama, and the international scene. Several noteworthy architects have made breakthroughs in Ecologically motivated architecture, one that aims for connection with the natural landscape that the country offers, like Studio Saxe; others focus on Energetic efficiency for the tropics, like Bruno Stagno; and now an opening is presenting itself in another approach. Perhaps to strive towards the future of sustainable architecture, one only has to take a step back, and learn from the basic principles of the societies that predate us, those who came before us. Sometimes the best way to move forward, is to take a step back.

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